

Fig. 1

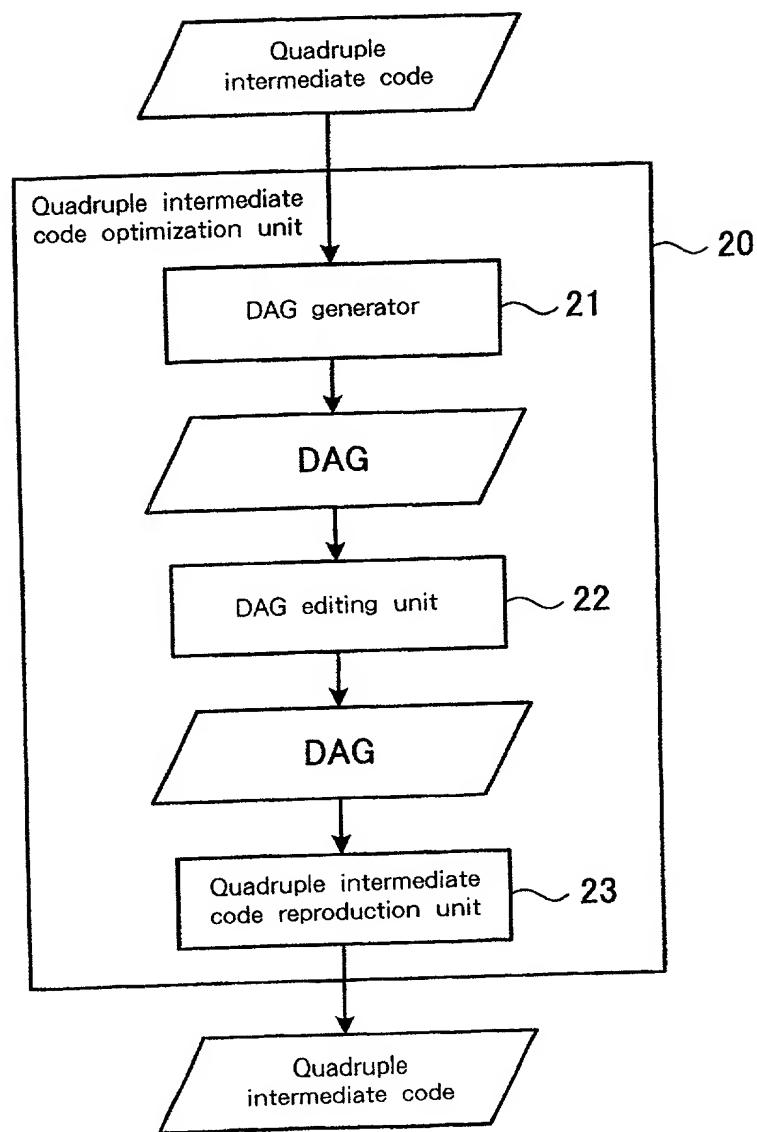


Fig. 2

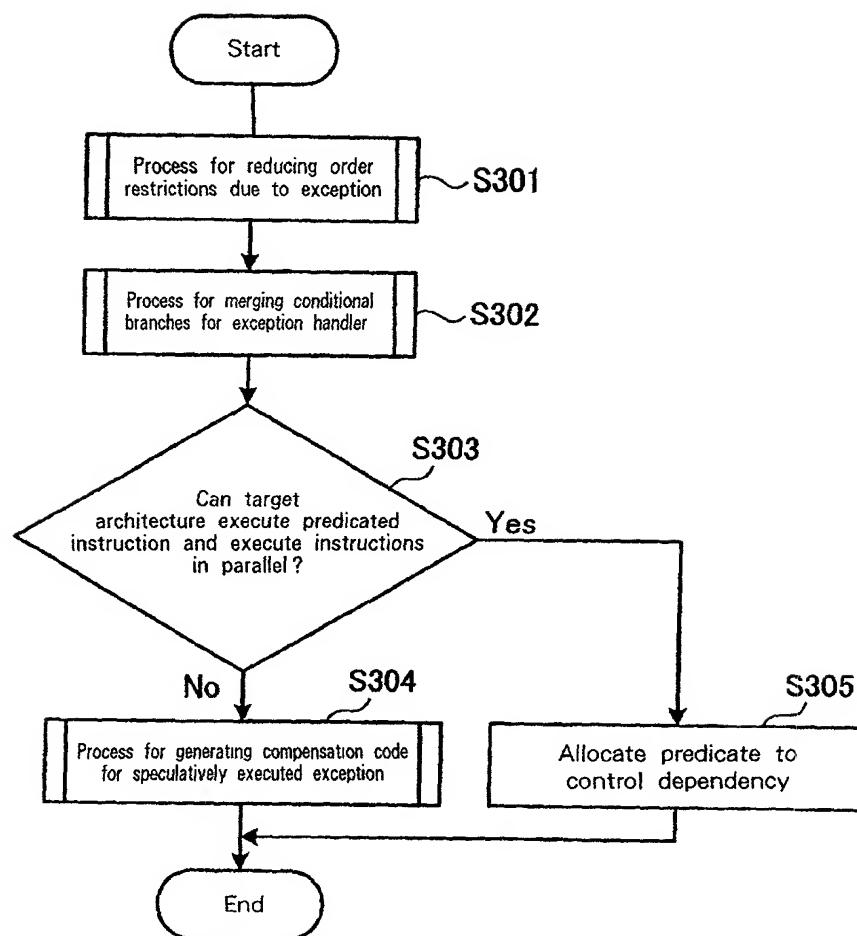


Fig. 3

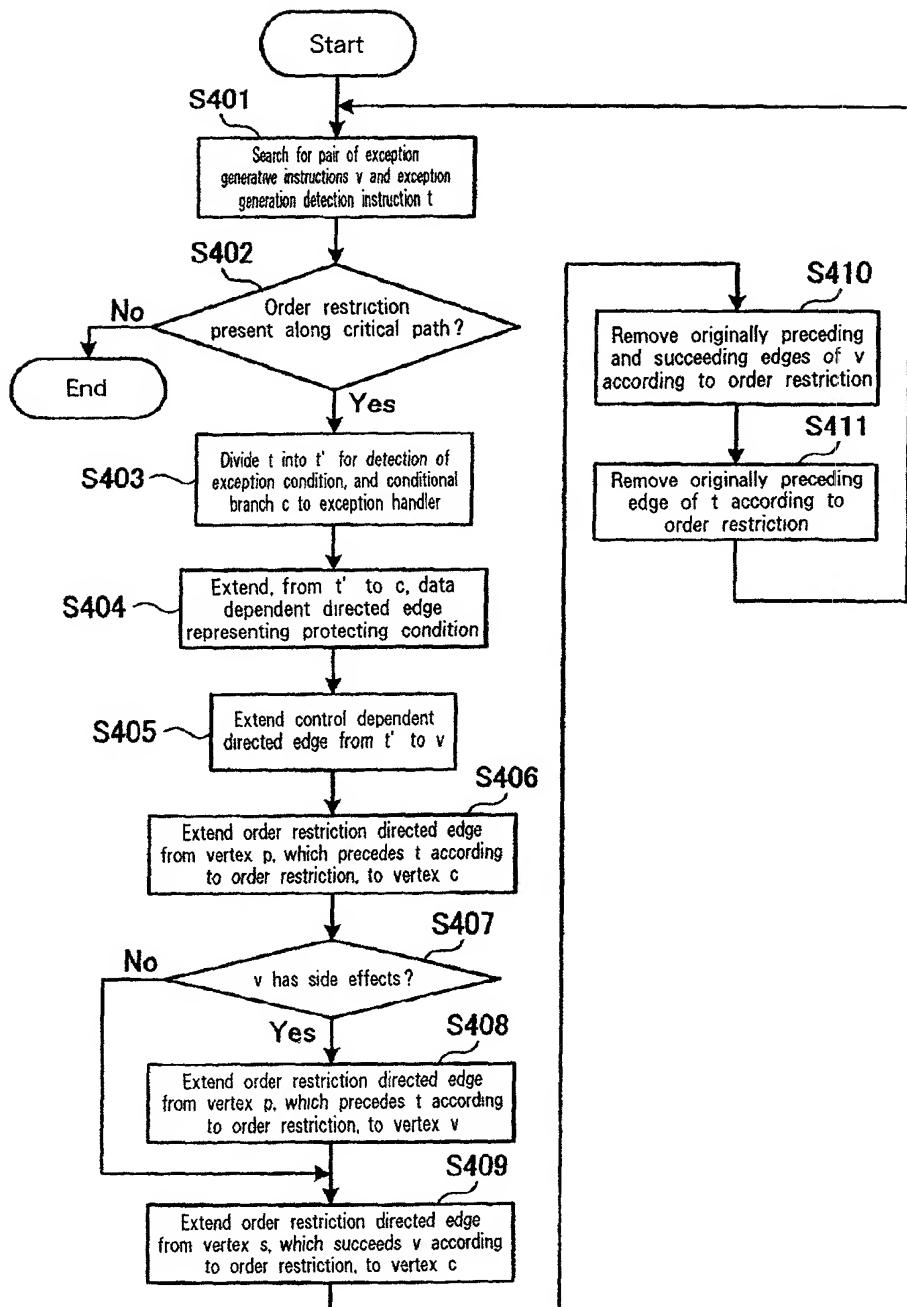


Fig. 4

TOP SECRET - EXECUTIVE

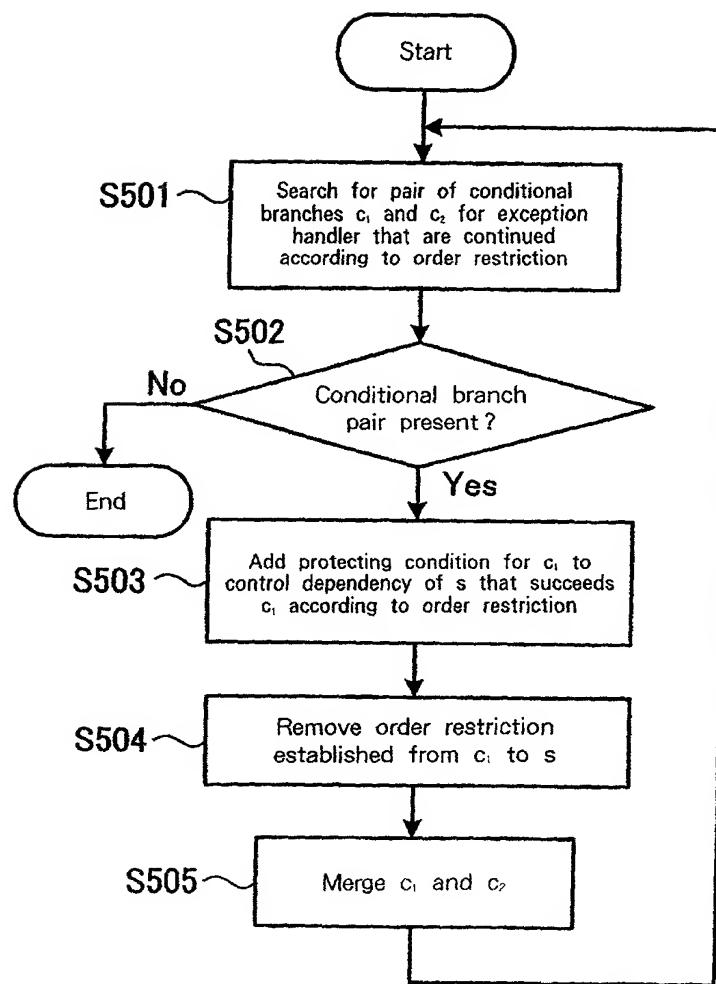


Fig. 5

TOP SECRET//COMINT

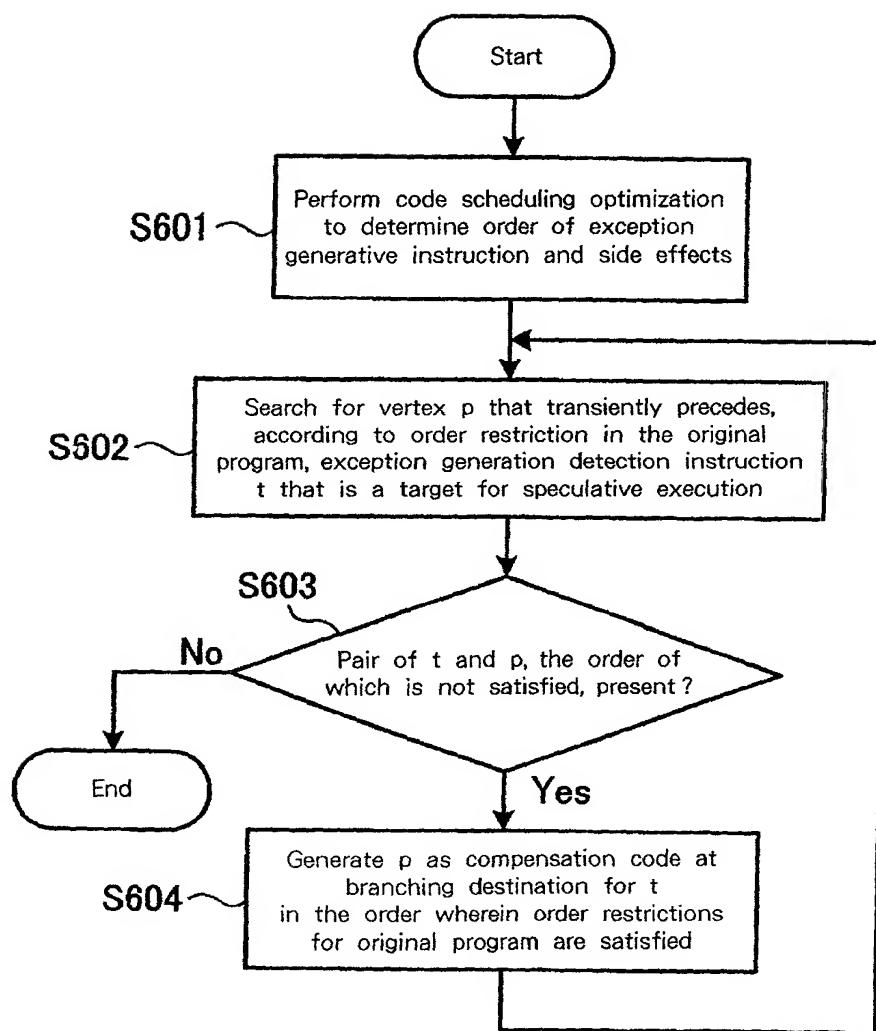


Fig. 6

(A)

```
double test (double a[], double b[], int i, int j) {
    return a[i] + b[j];
}
```

(B)

NULL		a
LENGTH	t=	a
SIZE		t, j
LOAD	x=	a, j
NULL		b
LENGTH	t=	b
SIZE		t, k
LOAD	y=	b, k
ADD	z=	x, y

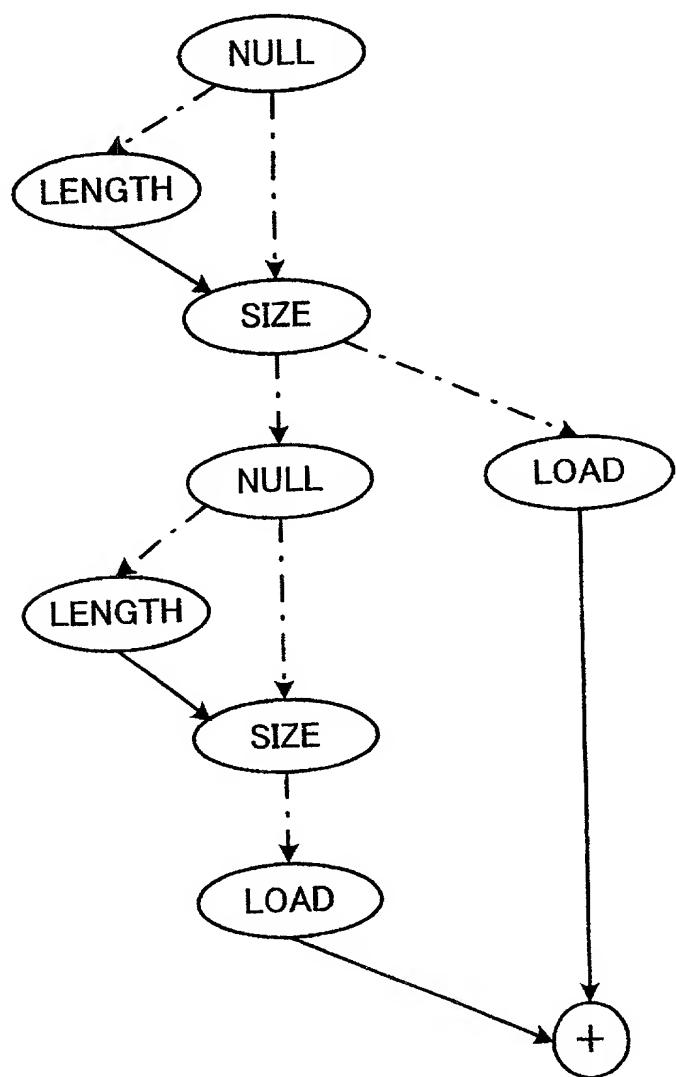


Fig. 8

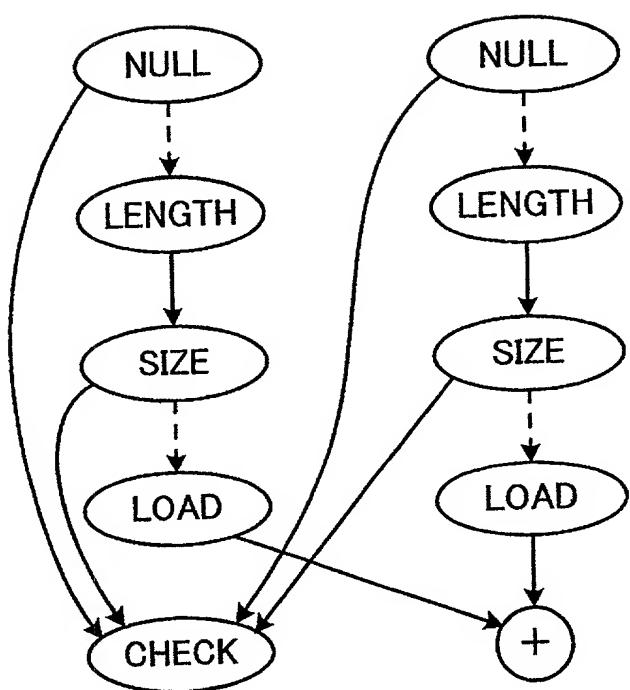


Fig. 9

(A)

```
void test (double a[], double b[], double c[],
           int i, int j, int k) {
    a[i] = b[j] + c[k];
}
```

(B)

NULL		b
LENGTH	t=	b
SIZE		t, j
LOAD	x=	b, j
NULL		c
LENGTH	t=	c
SIZE		t, k
LOAD	y=	c, k
ADD	z=	x, y
NULL		a
LENGTH	t=	a
SIZE		t, i
STORE		a, i, z

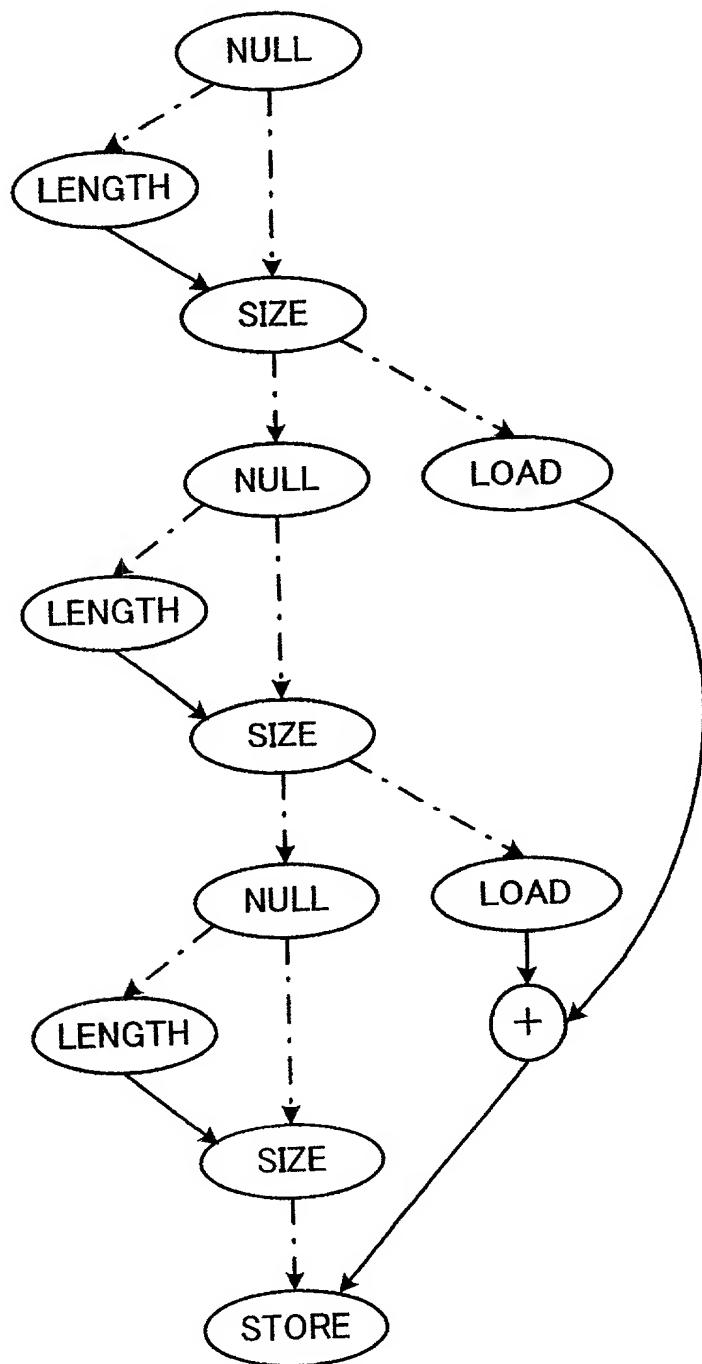


Fig. 11

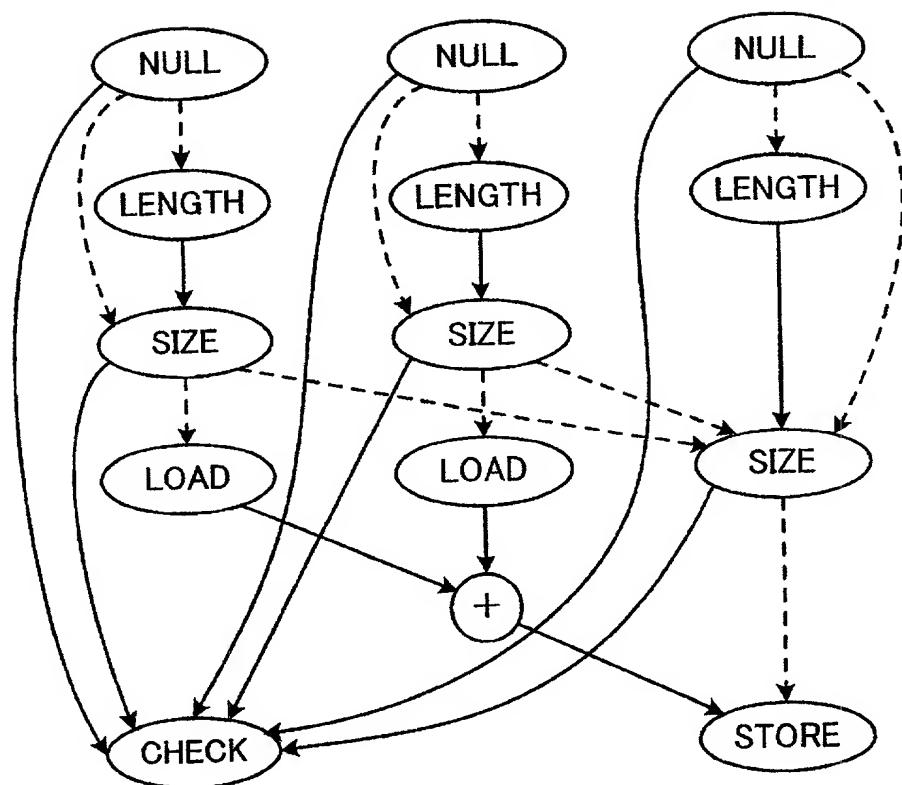


Fig. 12

TOP SECRET//COMINT

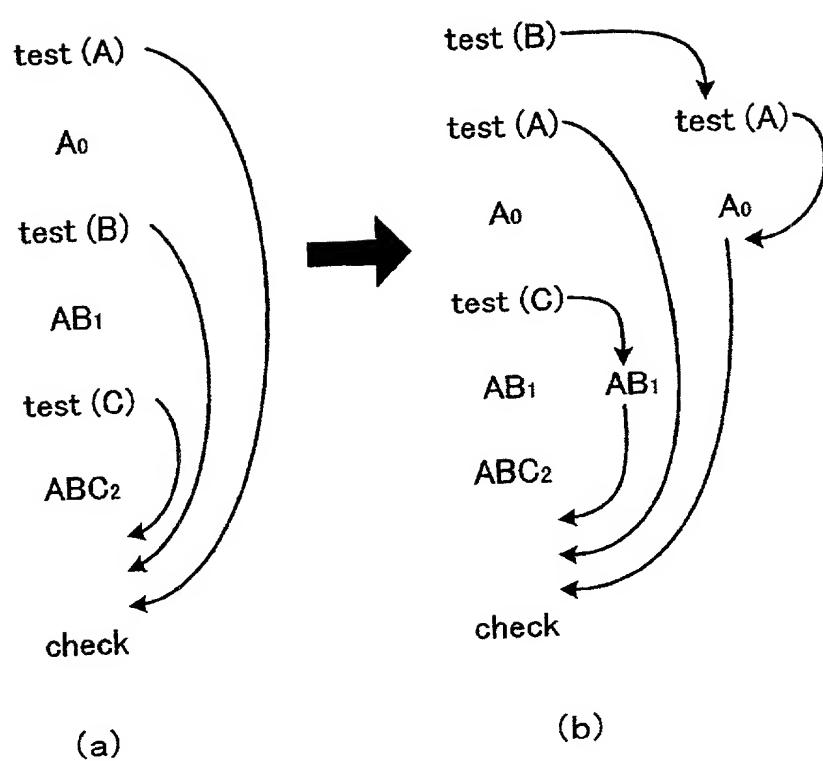


Fig. 13

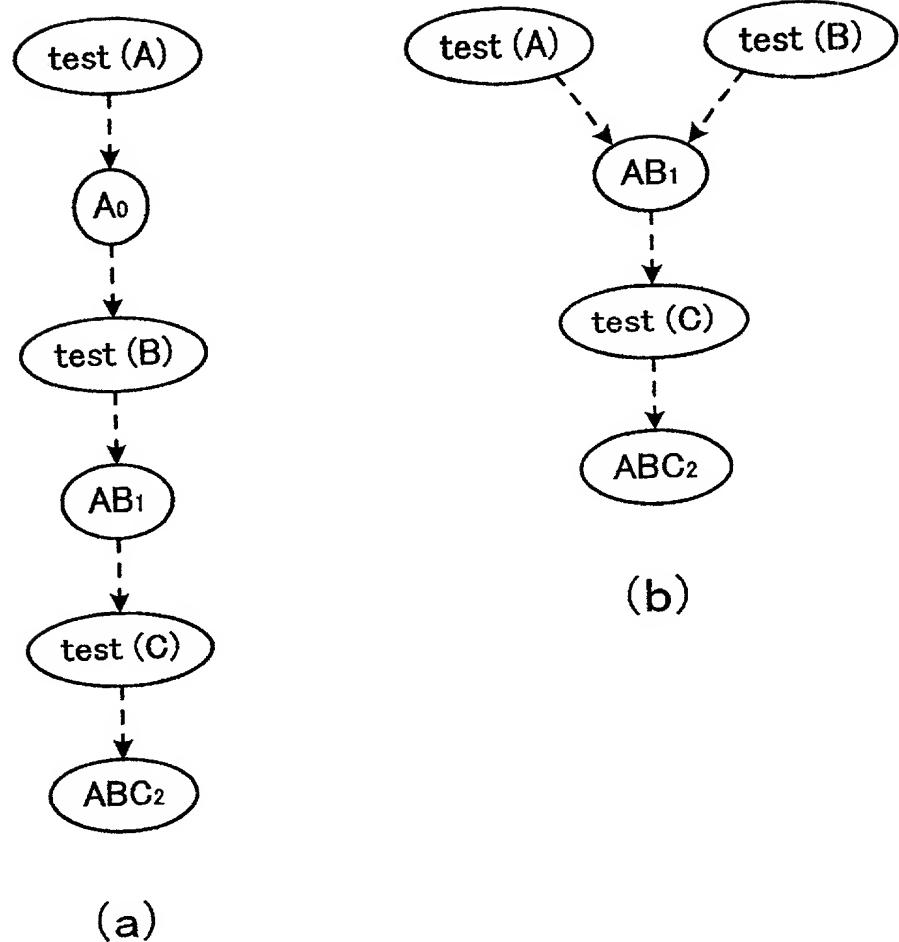


Fig. 14

	NullPointerException	ArrayIndexOutOfBoundsException	Check of representative flag
Normal execution	None	cmp idx, [arrh] jae eHandler	None
Speculative execution	cmp arrh, 00h jeq flHandler	cmp idx, [arrh] jae flHandler	cmp flag, 00h jne selHandler

Fig. 15

<u>Input</u>	
V :	A set of vertexes corresponding to quadruple operators
E :	A set of edges corresponding to the dependency between operators
$G(V, E)$:	DAG representing a program
$\tau \in V$:	Virtual vertex (top) preceding all operators with no preceding operator
$\iota \in V$:	Virtual vertex (bottom) succeeding all operators with no succeeding operator
$cy(v)$:	The number of machine cycles required for the execution of an operation at vertex v
$cp(G)$:	The critical path length of a DAG representing a program when the order restriction due to an exception is ignored
<u>Procedures (calculation of the slackness of a vertex)</u>	
$lb(v)$:	The level of vertex v from the bottom when the order restriction due to an exception is ignored
1.	$lb(v)=0$ when there is no succeeding vertex
2.	When there is a succeeding vertex,
	$lb(v) = \max(lb(s)) + cy(v),$ where $s \in succ(v)$ for a set of vertexes that due to exception succeed v along the edge other than the order restriction edge
$lt(v)$:	The level of vertex v from the top when the order restriction due to an exception is ignored
1.	$lt(v)=0$ when there is no preceding vertex
2.	When there is a preceding vertex,
	$lt(v) = \max(lt(p) + cy(v)),$ where $p \in pred(v)$ for a set of vertexes that due to exception precede v along the edge other than the order restriction edge
$sl(v)$:	The slackness of vertex v when the order restriction due to an exception is ignored
	$sl(v) = cp(G) - lt(v) - lb(v).$

Fig. 16

	NullPointerException	ArrayIndexOutOfBoundsException	Check of representative flag
Normal execution	<code>tlei arrh, 00h</code>	<code>lw len, [arrh] tllc idx, len</code>	None
Speculative execution	<code>cmp arrh, 00h beq flHandler</code>	<code>lw len, [arrh] cmpl idx, len bgt flHandler</code>	<code>bne cr2, selHandler</code>

Fig. 17

	NullPointerException	ArrayIndexOutOfBoundsException	Check of representative flag
Normal execution	<code>dmp.ne p1, p2 = 00h, arrh (p1) br eHandler</code>	<code>ld8 len = [arrh] cmp.ltu p1, p2 = idx, len (p1) br eHandler</code>	None
Speculative execution	<code>cmp.ne.and p1,p2 = 00h, arrh</code>	<code>ld8 len = [arrh] cmp.ltu.and p1, p2 = idx, len</code>	<code>(p1) br selHandler</code>

Fig. 18